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BIOAGRICULTURE: AN OPPORTUNITY FOR ISLAND GOOD LIVING

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The **Galapagos National Park Directorate** has its headquarters in Puerto Ayora, Santa Cruz Island, Galapagos and is the Ecuadorian governmental institution responsible for the administration and management of the protected areas of Galapagos.

The **Governing Council of Galapagos** has its headquarters in Puerto Baquerizo Moreno, San Cristóbal Island, and is the Ecuadorian governmental institution responsible for planning and the administration of the province.

The **Charles Darwin Foundation**, an international non-profit organization registered in Belgium, operates the Charles Darwin Research Station in Puerto Ayora, Santa Cruz Island, Galapagos.

Galapagos Conservancy, based in Fairfax, Virginia USA, is the only US non-profit organization focused exclusively on the long-term protection of the Galapagos Archipelago.

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Bioagriculture: An opportunity for island good living

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Ministry of Agriculture, Livestock, Aquaculture, and Fisheries

Introduction

In June 2013, the Ministry of Agriculture, Livestock, Aquaculture, and Fisheries (MAGAP – Spanish acronym), in agreement with the Ministry of the Environment, presented to the Presidency of the Republic the guidelines of the Bioagriculture Plan for Galapagos. The purpose of the Plan is to reposition agriculture in Galapagos as an activity that can contribute to food sovereignty of the local population and decrease the incidence of invasive plant species. Agriculture has a direct impact on invasive plant species through control of invasives by farmers, and an indirect impact by providing fresh food to the local market, thereby decreasing food imports from continental Ecuador and the accompanying risk of entry of new invasive species.

For decades, agriculture in Galapagos was seen only as causing the arrival and proliferation of invasive species, so neither the government nor the local community paid it much attention. Information now exists that shows the direct relationship between abandonment of agricultural land and the subsequent increase of area affected by invasive plant species. This article explores the need to implement the Bioagriculture Plan for Galapagos, and describes its key components.

Agriculture and invasive plant species

The abandonment of agriculture in Galapagos is evident, as noted within the context of total population growth, where the economically active population (EAP) working in agriculture has declined significantly (Figures 1 and 2).

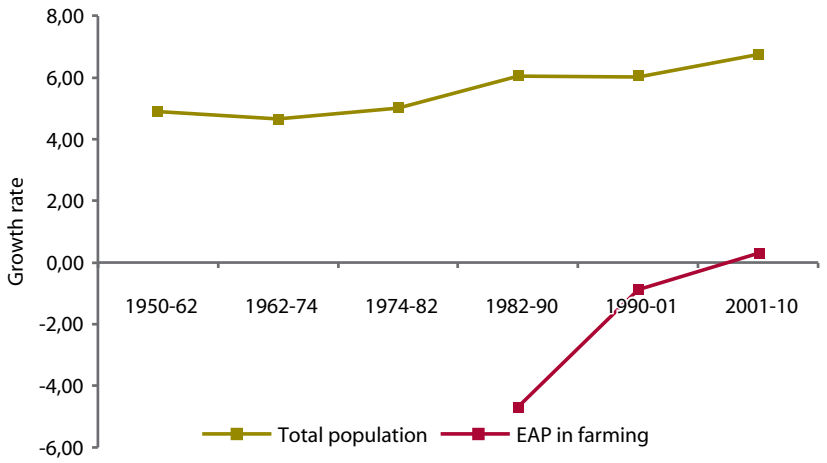

Figure 1. Evolution of the growth rates of the total population and the Economically Active Population (EAC). Source: INEC Censos Nacionales de Población y Vivienda 1950 – 2010; Censo Galápagos 2006.

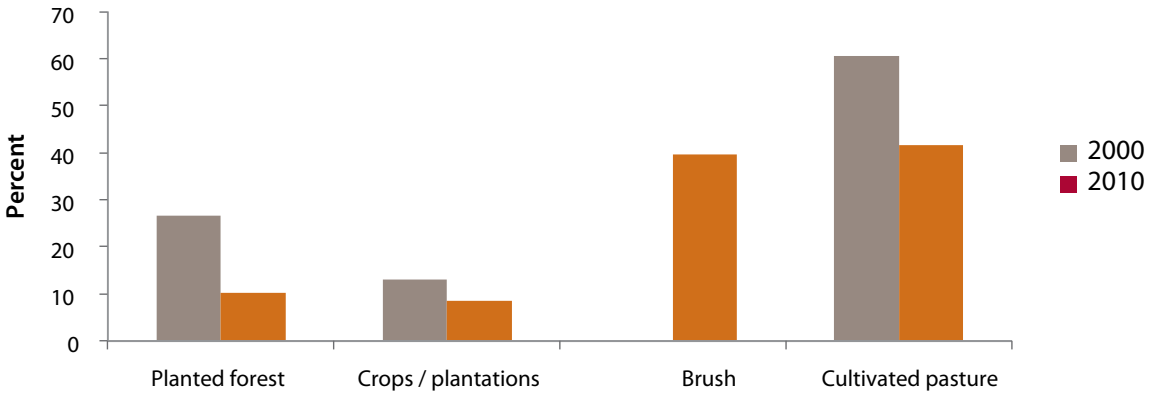

Figure 2. Changes in land use in the agricultural zone between 2000 and 2010. Source: INEC - Censo agropecuario nacional, 2000; Catastro rural SIGTIERRAS, 2010.

The rural cadastre completed by the National System of Information and Management of Rural Land (SIGTIERRAS – Spanish acronym) in 2010 delineates the vegetation cover and land use within the agricultural zone, indicating that 9143 ha (37% of the agricultural zone) are affected by invasive plant species. The situation is most severe in San Cristóbal, where approximately 60% of the agricultural area is affected. Also a lower proportion of the population lives in the rural sector (10.7%) on San Cristóbal, compared to 17.5% in the Galapagos Province in general (INEC, 2010).

Table 1. Land use in the agricultural zone by canton-island.

Land use	Isabela (ha)	Santa Cruz (ha)	San Cristobal (ha)
Mountains and forests	367	2180	1404
Permanent crops	217	822	635
Annual crops	49	72	132
Invasive species	2307	2311	4525
Pasture	2103	5840	1609
Total	**5042**	**11,224**	**8306**

Using the same SIGTIERRAS information and maps developed by the Charles Darwin Foundation (CDF/GNPS, 2006; Gardener *et al.*, 2011), the area covered with the most common invasive species has been determined by island. Within the agricultural area, guava (*Psidium guajava*) is the most widespread species, occupying 63% of the agricultural zone affected by invasive species. The least affected island is Floreana, where only 8% of the agricultural area is affected by invasive species.

However, there is evidence that farmers can manage and control invasive species. It is widely known that in El Cascajo, a farming area on Santa Cruz with small land owners dedicated to the production of vegetables, invasive species are not a problem. In 2001-02, in the sector of San Joaquín in San Cristóbal, 34 families recovered 350 ha of grassland that had been invaded by blackberry (*Rubus niveus*) and guava, with modest support from the IPADE-FUNDAR project. The blackberry was eradicated and any seedlings that sprout in isolation are eliminated as are all other undesired species. The few guava trees purposely left scattered throughout the grasslands form part of a silvopastoral system managed by the farmers.

Labor available to the agriculture sector

According to data from the latest population and housing census (INEC, 2010), there were 762 individuals working in the agriculture sector in Galapagos, which represents one farm worker for every 31 ha of agricultural land. At the national level, there is an average of one worker for every 10 ha.

Even leaving out the agricultural area covered by invasive species, it appears that that the current agricultural workforce in Galapagos is insufficient to meet the needs of the sector. However, these figures may be low because a significant portion of the agricultural workforce comes from family farms where family members often have other occupations and devote their surplus time to agricultural

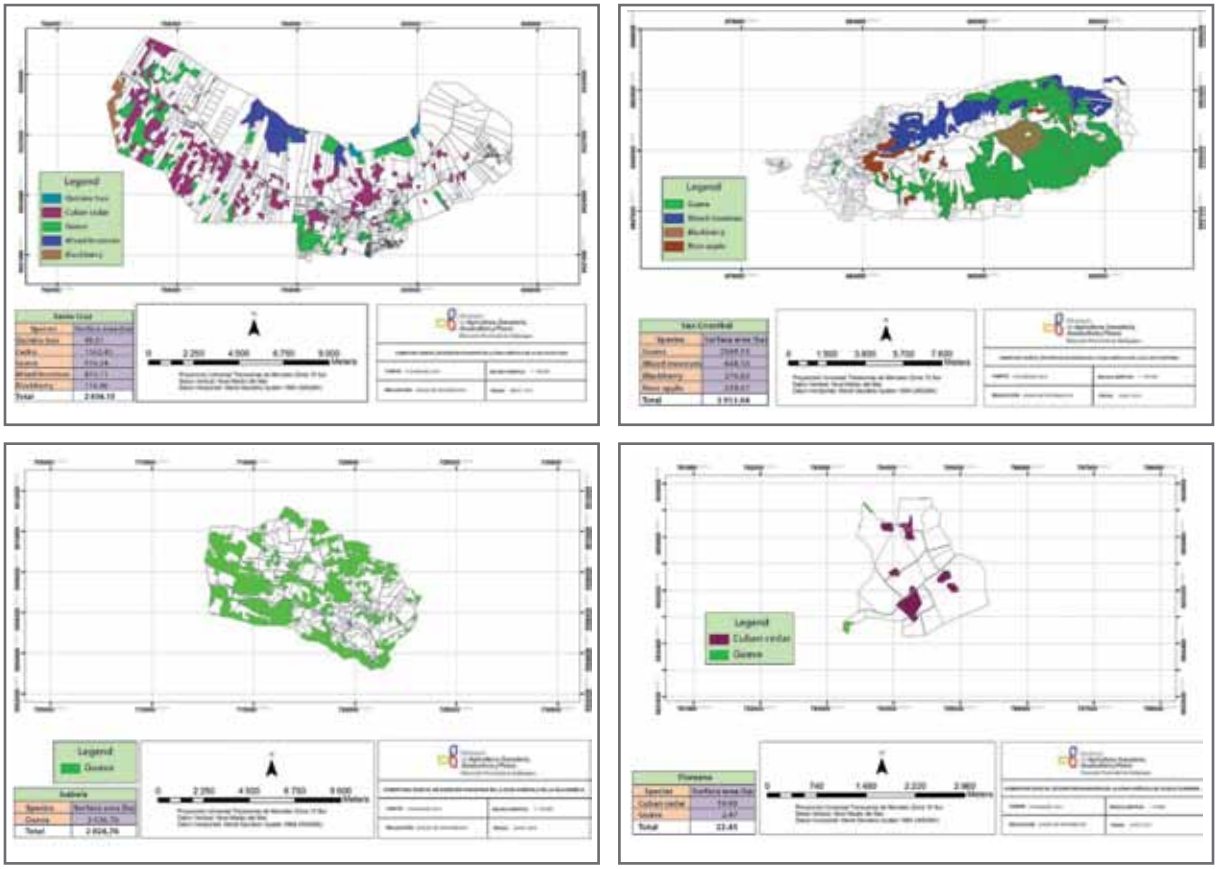

Figure 3. Invasive plant species cover by species and island. Source: SIGTIERRAS, Catastro rural 2010

activities; these family members are not reflected in official statistics. Additionally, a large number of agricultural workers have not established their residence status in Galapagos, which contributes to the lack of clear figures related to "insufficiency of the local workforce."

A set of factors explains, in varying degrees, the shortage of labor in the agricultural sector. Tourism generates 43% of the gross domestic product (GDP) of the province and experienced an average annual growth rate of 19.8% from 2006 to 2011, while the agriculture sector decreased by 31.3% during the same period (Utreras *et al.*, 2014).

Not only are agricultural activities less well paid, in general agriculture is not valued by the society as a whole. In addition, the presence of invasive species, such as ants, creates an inhospitable environment for the activity. Finally, the immigration system in Galapagos involves a series of restrictions for hiring workers from outside the Archipelago.

The Bioagriculture Plan for Galapagos

Effective implementation of the Bioagriculture Plan for Galapagos is essential in order for agriculture to reclaim its important role in Galapagos. Making agriculture profitable requires improving the quality of production, and producing safe and nutritious food using ecofriendly methods. This recovery should also ensure the health of farmers, consumers, and the environment. To achieve this requires the support of the whole of Galapagos society and its institutions. The proposed transition process requires that farmers have access to production factors and continual training opportunities.

Agriculture for life, proposed in the Bioagriculture Plan for Galapagos, relies on the diversification of agro-ecosystems, through polyculture, crop rotation and association, and the design and implementation of agroforestry systems. The Bioagriculture Plan proposes to increase productivity per area, promoting the generation of biomass and nutrient recycling, and contributing to the establishment of microclimates to reduce moisture loss caused by the direct impact of air flow and solar radiation on the ground. It promotes synergetic cultivation and breeding systems that favor trophic redundancy and allow a reduction in the use of fertilizers, pesticides, and other external inputs, as well as generate greater resiliency to changes in climate. Diversification of production systems also provides a variety of food products for personal consumption and local markets, which ultimately builds socioecological resilience (Nicholls, 2013). This approach is widely accepted "as a means of improving the resilience and sustainability of food systems; agro-ecology is supported by an increasing number of experts within the scientific community and agencies and international organizations such as the Food and Agriculture Organization of the United Nations

(FAO), the United Nations Environment Program (UNEP), and Biodiversity International. Also it is gaining ground in countries as diverse as the United States, Brazil, Germany, and France" (UN, 2011).

In this context, Galapagos needs mechanisms that connect producers with consumers. It is essential to reduce the margins earned by commercial intermediaries, which erode the profits of farmers. It is important to actively promote responsible consumption, raise awareness, and motivate and educate at all levels, not just within the formal education system. MAGAP, in collaboration with Conservation International, has begun a campaign involving 18 institutions to promote local production and consumption. Appropriate spaces must be created to facilitate direct contact between producers and consumers and to enable not only the sale and purchase of goods, but also a broader range of relationships to enhance the exchange of knowledge, building identities, strengthening societal cohesion, and reinforcing a sense of citizenship.

The social dynamics and synergies between farmers and consumers differ according to circumstances and context. In continental Ecuador, the majority of production, exchange, and consumer networks have been promoted by producer groups such as the Agro-ecological Network of Loja (RAL – Spanish acronym) or the Ecuadorian Corporation of Biological Producers (PROBIO – Spanish acronym). Some networks, such as the Agro-Ecological Network of the Austro (RAA – Spanish acronym), have been promoted by public-private partnerships. In some of these associations, such as Agro-ecological Producers and Trade Association of Tungurahua (PACAT – Spanish acronym), the public sector plays a leading role. In all cases, there is a clear need and justification for public policies to strengthen and expand the networks (MAGAP, 2014). The special regime of Galapagos creates favorable conditions for participatory design of public policies to promote healthy food production, to make this production available to consumers, and to regulate the entry of foodstuffs that can be produced in the Archipelago.

Three specific objectives of the Bioagriculture Plan for Galapagos are:

1. Transform agriculture into the primary human activity in Galapagos in such a way that it contributes to the conservation of the natural heritage of Galapagos, especially with regards to controlling invasive species, through the design and implementation of highly efficient agro-ecological production systems.

2. Contribute to economic sustainability in Galapagos through the promotion of local markets that function under the principles of a social and solidarity-based economy.

3. Consolidate a research system based on dialogue, sharing knowledge, and expanding local capacity to create and innovate.

Perspectives

The new model of insular production represents a radical change in thinking about the development of the agriculture sector of Galapagos. It begins with an acknowledgement that the intrinsic characteristics of the ecosystem, as well as the will of the local society and the State are all vital to building a sustainable economic system that will address social and solidarity issues and helps achieve the goal of "good living" in Galapagos.

The role of MAGAP in relation to the implementation of the Bioagriculture Plan for Galapagos is to serve as the lead public organization of a multi-sector effort, in direct coordination with the Ministry of the Environment. This process is supported directly by the producers through the Farmers' Citizen Council of Galapagos (CCSC-G – Spanish acronym).

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